Supplemental material

Figure 14 shows ignition in 8% hydrogen-air mixture, leading to a cyclic (puffing) flame. This phenomenon was investigated in detail by Boettcher et al. [34].

Figure 15 shows ignition in 12% hydrogen-air mixture, leading to an expanding flame.

Figure 16 shows single-puff ignition in 5% hydrogen-air mixture. The ignition source in this experiment was a 0.4 mm Kanthal A-1 wire supported by a ceramic tube. The wire ignited the mixture at a surface temperature of 1112 K after a heating time of 493 ms. Single-puff ignition and plume formation are similar to the observations from the glow plug. Time scales and leading-edge flame shape differ due to differences in thermal plume extent and strength.

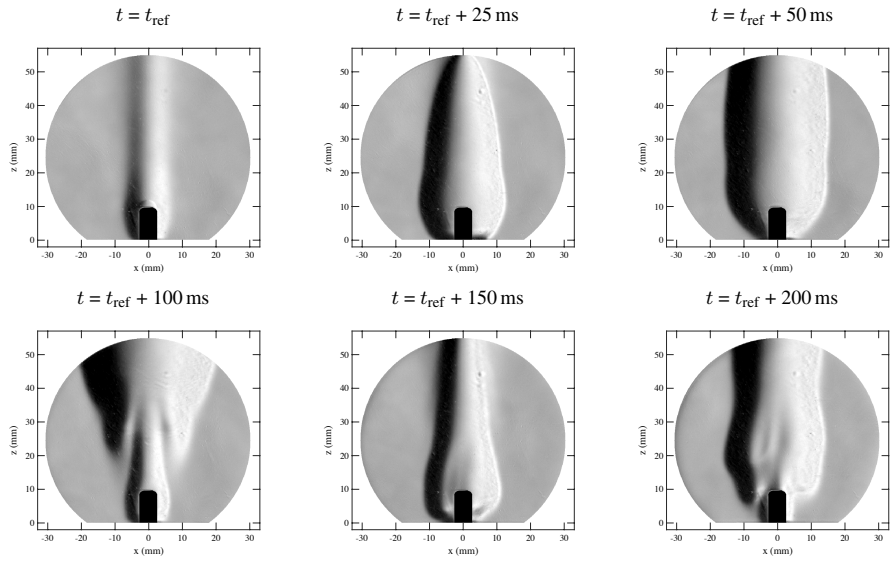

Figure 14: High-speed schlieren sequence of ignition in 8% hydrogen-air mixture; Puffing flame.

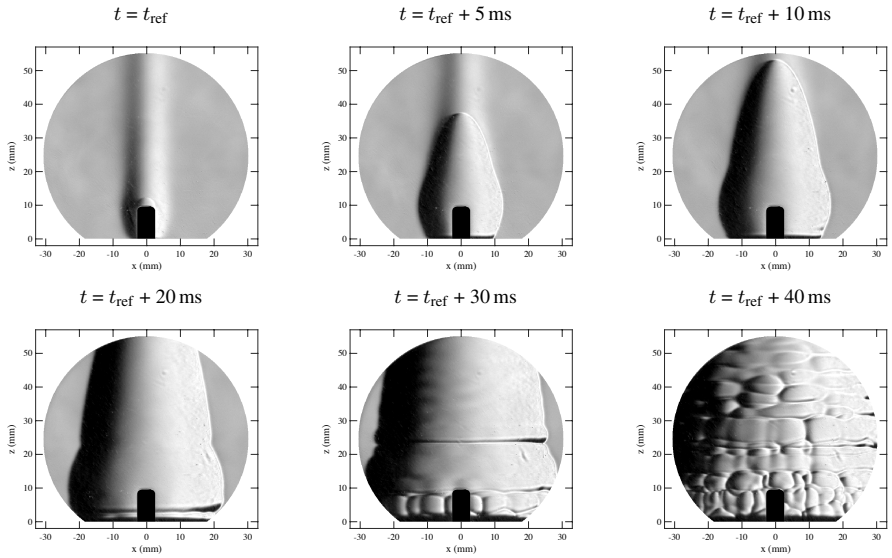

Figure 15: High-speed schlieren sequence of ignition in 12% hydrogen-air mixture; Expanding flame.

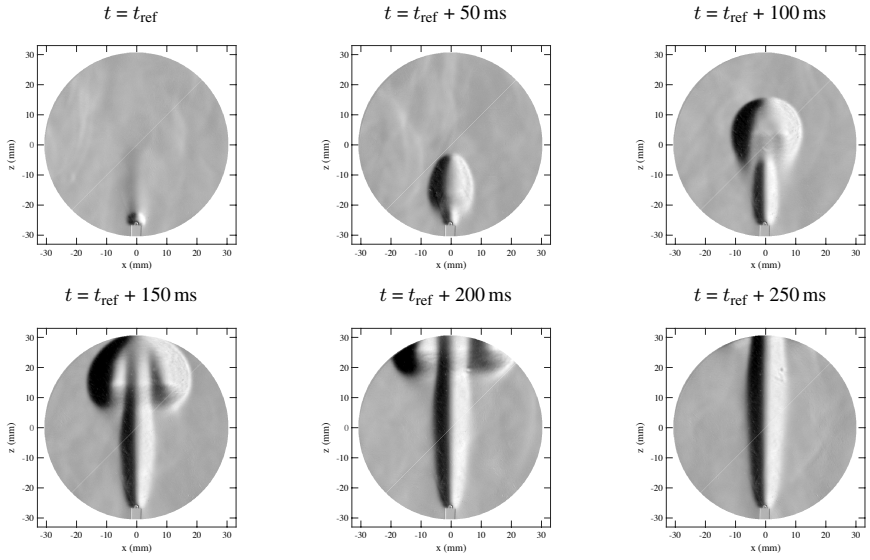

Figure 16: High-speed schlieren sequence of ignition from a u-shaped hot wire (diameter 0.2 mm; exposed length 3 mm) supported from below by a ceramic tube in 5% hydrogen-air mixture; Singe-puff ignition.